

Surface Roughness

Excerpt from JIS B 0601 (1994)
and JIS B 0031 (1994)

1. Categories of surface roughness

Definitions and indications for surface roughness parameters (for industrial products) are specified. They are arithmetical mean roughness (Ra), maximum height (Ry), ten-point mean roughness (Rz), mean spacing of profile irregularities (Sm), mean spacing of local peaks of the profile (S) and profile bearing length ratio (p). Surface roughness is given as the arithmetical mean value for a randomly sampled area.

(Mean center line roughness (Ra_m) is defined in the annexes of JIS B 0031 and JIS B 0601.)

Typical ways for obtaining surface roughness

Arithmetical mean roughness (Ra)	Maximum peak (Ry)	Ten-point mean roughness (Rz)
A section of standard length is sampled from the mean line on the roughness chart. The mean line is laid on a Cartesian coordinate system where in the mean line runs in the direction of the x-axis and magnification is the y-axis. The value obtained with the formula on the right is expressed in micrometer (μm) when y=f(x).	A section of standard length is sampled from the mean line on the roughness chart. The distance between the peaks and valleys of the sampled line is measured in the y direction. The value is expressed in micrometer (μm).	A section of standard length is sampled from the mean line on the roughness chart. The distance between the peaks and valleys of the sampled line is measured in the y direction. Then, the average peak is obtained among 5 tallest peaks (Yp), as is the average valley between 5 lowest valleys (Yv). The sum of these two values is expressed in micrometer (μm).
$Ra = \frac{1}{l} \int_0^l f(x) dx$	$Ry = Rp + Rv$	$Rz = \frac{Yp1 + Yp2 + Yp3 + Yp4 + Yp5 + Yv1 + Yv2 + Yv3 + Yv4 + Yv5}{5}$ Yp1, Yp2, Yp3, Yp4, Yp5 : Tallest 5 peaks within sample Yv1, Yv2, Yv3, Yv4, Yv5 : Lowest 5 peaks within sample

Note: To obtain Ry, sample only the standard length. The part, surface irregularities and standard length are not to be interpreted as structures, should be avoided.

Reference: Relationship between arithmetical mean roughness (Ra) and conventional symbols

Arithmetical mean roughness		Standard length of Ry, Rz		Triangular indication
Preferred number series	Max. height Ry	Preferred number series	Standard length r (mm)	
0.012 a	0.05 s	0.05 z	0.08	
0.025 a	0.1 s	0.1 z		
0.05 a	0.2 s	0.2 z	0.25	
0.1 a	0.4 s	0.4 z		
0.2 a	0.8 s	0.8 z		
0.4 a	1.6 s	1.6 z	0.8	
0.8 a	3.2 s	3.2 z		
1.6 a	6.3 s	6.3 z		
3.2 a	12.5 s	12.5 z	2.5	
6.3 a	25 s	25 z		
12.5 a	50 s	50 z		
25 a	100 s	100 z	8	
50 a	200 s	200 z		
100 a	400 s	400 z		

※ The interdependence for 3 classes is not strictly enforced.

※ The evaluation lengths of Ra, Ry and Rz : Five times the cut-off value and standard length respectively.

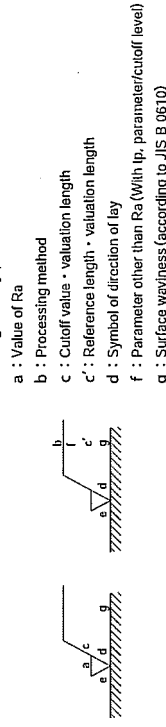
Technical Drawings-METHOD OF INDICATING SURFACE TEXTURE ON DRAWING

Excerpt from
JIS Z 6003 (1994)

1. Positions of respective indicating symbols relative to indicating symbol of surface

Each grain surface position is indicated as shown in Drawing 7 This includes surface roughness, cutoff value or reference length, processing method, symbol of direction of lay, surface waviness, etc.

Drawing 7 Entry position of each indication



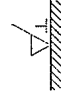
Note: Items other than a and f are added as necessary.

Reference: The location of lay of e in Drawing 7 is given as the finish allowance in ISO 1302.

Examples Indicating Surface Texture on Drawing

Symbol	Meaning	Figure
=	Parallel to the projected surface on which the direction of lay of the cutting blade is indicated. (ex) Shaped surface	
⊥	Direction of lay of cutting blade (ex) Shaped surface (when viewed from the side), machined or cylindrical ground surface.	
X	Intersection of two diagonal lines on the projected surface on which the direction of lay of the cutting blade is indicated. (ex) Honing finished surface	
M	Multidirectional intersection of non-directional points on the projected surface on which the direction of lay of the cutting blade is indicated. (ex) Rapping finished surface, super finished surface, face milled or end milled surface in surfacing feed direction	
C	Concentric circles roughly centered on the same point on the surface on which the direction of lay of the cutting blade is indicated. (ex) Facing surface	
R	Radiating shape roughly centered on the same point on the surface on which the direction of lay of the cutting blade is indicated.	

Examples indicating direction of lay



Examples indicating the upper limit and lower limit of Ra



Examples indicating processing method

